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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/634,556	08/07/2000	Shyh-Ming Chang	64,600-065	3972

7590 08/19/2003

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EXAMINER

PHAM, THANHHA S

ART UNIT PAPER NUMBER

2813

DATE MAILED: 08/19/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/634,556

Applicant(s)

CHANG ET AL

Examiner

Thanhha Pham

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02 June 2003.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-16 is/are pending in the application.
- 4a) Of the above claim(s) 17-24 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-16 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

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DETAILED ACTION

In view of the appeal brief filed on June 5, 2000, PROSECUTION IS HEREBY REOPENED. New grounds of rejection are set forth below.

To avoid abandonment of the application, appellant must exercise one of the following two options:

- (a) file a reply under 37 CFR 1.111 (if this Office action is non-final) or a reply under 37 CFR 1.113 (if this Office action is final); or,
- (b) request reinstatement of the appeal.

If reinstatement of the appeal is requested, such request must be accompanied by a supplemental appeal brief, but no new amendments, affidavits (37 CFR 1.130, 1.131 or 1.132) or other evidence are permitted. See 37 CFR 1.193(b)(2).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

1. Claims 1-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's Admitted Prior Art (AP) in view of Chang et al [US 5,393,697] and Estes et al [US 6,189,208].

➤ With respect to claims 1, 7-9 and 12-13, APA, specification pages 1-10 and figs 1A-1F, substantially discloses the claimed method for forming electrically conductive bumps on a wafer comprising steps of:

providing a wafer (10, fig 1A) having an active surface (12), a plurality of conductive elements (14) formed on the active surface, and a passivation layer (16)

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insulating said plurality of conductive elements from each other (see page 5 lines 17-23 and page 6 lines 1-4) **[claim 1]**;

sputter depositing a first metal layer (18, e.g. Al, fig 1B) on top of said plurality of conductive elements and said passivation layer (see page 6 lines 5-10 and page 7 lines 12-13) **[claim 1]**;

forming a plurality of bumps (22, fig 1D) of an insulating material, using solvent-containing polymeric paste material such as polyimide, each on top of one of said plurality of conductive elements (see page 6 lines 11-23 and page 8 lines 18-23) **[claims 1, 8-9, and 12-13]**;

heating said plurality of bumps (specification page 7) **[claim 1]**;

sputter depositing a second metal layer (24, e.g. Al) on top of said plurality of bumps and said first metal layer (see page 7 lines 10-15) **[claim 1]**; and

patterning and removing said first and second metal layer in areas between said plurality of bumps **[claim 1]**.

APA fails to teach:

a) heating said plurality of bumps at a temperature of at least 100°C **[claim 1]**; and

b) forming said plurality of bump by stencil printing technique **[claims 1, 7-9 and 12-13]**.

Regarding to a), the claimed range temperature of annealing said plurality of bumps is considered to involve routine optimization while has been held to be within the level of ordinary skill in the art. See Chang et al (col 5 lines 26-52) as an example to

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shows annealing to cure the bump at a temperature of 160°C. It would have been obvious for those skilled in the art modify the process of APA by choosing the annealing temperature of at least 100°C as an optimized parameter, per taught by Chang et al, to heat the plurality of bumps to cure the plurality of bumps.

Regarding to **b)**, Estes et al (fig 2, col 2 lines 40-52, col 3 lines 40-49 and col 4) teaches stencil-printing as an advantage technique to print plurality of bumps due to its ease of control and precision. It would have been obvious for those skilled in the art to modify the process of APA by using stencil-printing technique, as taught by Estes et al, to form the plurality of bumps with a better control and precise process of low production cost.

Based on what being mentioned above, it would have been obvious for those skilled in the art to modify process of APA by **a)** choosing the annealing temperature as taught by Chang et al and **b)** using stencil-printing technique as taught by Estes et al to form and cure the plurality of the bumps for forming the electrically conductive bumps as being claimed with low cost and better control and precision.

➤ With respect to claims 2, 6, and 10-11, range of spacing between said plurality of conductive elements, range of the first metal thickness, range of bump width, and range of bump thickness are considered to involve routine optimization while has been held to be within the level of ordinary skill in the art. As noted in *In re Aller* 105 USPQ233, 255 (CCPA 1955), the selection of reaction parameters such as temperature and concentration would have been obvious.

"Normally, it is to be expected that a change in temperature, or in concentration, or in both, would be an unpatentable modification. Under some circumstances, however, changes such as these may be impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from the results of the prior art...such ranges are termed "critical ranges and the applicant has the burden of proving such criticality... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation."

See also In re Waite 77 USPQ 586 (CCPA 1948); In re Scherl 70 USPQ 204 (CCPA 1946); In re Irmischer 66 USPQ 314 (CCPA 1945); In re Norman 66 USPQ 308 (CCPA 1945); In re Swenson 56 USPQ 372 (CCPA 1942); In re Sola 25 USPQ 433 (CCPA 1935); In re Dreyfus 24 USPQ 52 (CCPA 1934).

➤ With respect to claim 3, aluminum and copper are known material for forming conductive element on the active surface of substrate for forming interconnection path of a device. See Chang et al (fig 1A, col 3 lines 24-26) as an example that teaches forming the conductive element (26) in aluminum. Selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in *Sinclair & Carroll Co., Inc. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945). "Reading a list and selecting a known compound to meet known requirements is no more ingenious than selecting the last piece to put in the last opening in a jig - saw puzzle." (65 USPQ at 301).

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- With respect to claim 4, APA (fig 1A, page 5 lines 22-23 and page 6 lines 1-4) discloses forming the passivation layer (16) in an insulating material.
- With respect to claim 5, APA (fig 1B, page 6 lines 9-11 and page 7 lines 15-16) discloses sputtering depositing said first metal layer in a material (18, e.g. aluminum) selected from the group consisting of Al, Ni, Ti, W, Cu, Cr and alloy thereof.
- With respect to claim 14, APA (fig 1E, page 7 lines 11-18) discloses depositing said second layer in a material (24, e.g. aluminum) selected from the group consisting of Al, Ni, W, Pt, Pd, Cu, Cr, Ag, Au, In, Sn, Pb and alloys thereof.
- With respect to claim 15, APA (figs 1E-1D, page 7 lines 19-22) discloses patterning said first and said second metal layer by a photolithographic method.
- With respect to claim 16, removing the first and second metal layer by photolithographic and wet etch method is a known method to provide electrically conductive bump on a wafer. See Chang et al (figs 8G-8J, col 4 lines 43-58) as an example that teaches removing the first and second metal layers (36 and 38) by photolithographic and wet etch method. It would have been obvious for those skilled in the art to use the photolithographic and wet etch method as a known technique for removing the first and second metal layers in the process of APA in view of Chang et al and Estes et al to provide electrically conductive bumps including the first and second metal layer as being claimed.

Response to Arguments

2. Applicant's arguments filed 6/2/03 have been fully considered but they are not persuasive.

Regarding to Applicant's argument on pages 9-11, Applicant argues that rejection of obviousness to the claimed invention over APA, Chang et al and the Estes et al is improper because Estes et al's printing of electrically conductive polymer bumps is conducted on flip chips while the present invention printing method of insulating polymeric bumps is conducted on a wafer. In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Moreover, the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981).

In this case, APA discloses forming a plurality of bumps of an insulating material, wherein the insulating material being made of a solvent-containing polymeric paste such as polyimide, each on top of one of the plurality of conductive elements except using the stencil-printing to print said plurality of bumps. However, Estes et al recognizes the advantage of using stencil-print to form plurality of bumps with low cost and better

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control and precision wherein the bump being made of a solvent-containing polymeric paste. Furthermore, Estes et al discloses stencil-printing can be applied to either insulating material (electrically insulating adhesive paste formed of polymer) or conductive material (electrically conductive polymer). It would have been obvious for those skilled in the art to combine the teaching of Estes et al to use the stencil-printing in the process of APA in view of Chang et al and Estes et al to form the plurality of bumps with the improved process control and low cost.

Based on what being mentioned above, the combination process of APA in view of Chang et al and Estes et al clearly teaches or suggests the claimed invention.

Conclusion


Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanhha Pham whose telephone number is (703) 308-6172. The examiner can normally be reached on Monday-Thursday 8:00 AM - 7:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead Jr., can be reached on (703) 308-4940. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-3432 for regular communications and (703) 308-7725 for After Final communications.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

Thanhha Pham
August 12, 2003


CARL WHITEHEAD, JR.
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